

IN THE CLAIMS

Please amend the claims as follows:

1. (Cancelled)
2. (Original) A semiconductor device comprising:
 - a lower hydrogen-barrier film;
 - one or more capacitors, each formed on the lower hydrogen-barrier film and including a lower electrode, a capacitive insulating film, and an upper electrode;
 - a first interlayer dielectric film formed so as to cover the capacitor; and
 - an upper hydrogen-barrier film covering the top and lateral portions of the capacitor, wherein an opening, which exposes the lower hydrogen-barrier film where the lower hydrogen-barrier film is located around the capacitor, and which is tapered and flares upward, is formed in the first interlayer dielectric film, and
 - the upper hydrogen-barrier film is formed along the lateral and bottom faces of the opening, and is in contact with the lower hydrogen-barrier film in the opening.
3. (Currently amended) The semiconductor device of Claim 2, wherein ~~the lower electrode, capacitive insulating film, and upper electrode of the capacitor~~ has have a cross-sectional configuration that is tapered and flares upward.
4. (Currently amended) The semiconductor device of Claim 2, further comprising:
 - a second interlayer dielectric film formed on the first interlayer dielectric film so as to cover the capacitor,
 - ~~wherein an open trench, which exposes the lower hydrogen-barrier film, is formed in the first interlayer dielectric film, and~~
 - the upper hydrogen-barrier film includes a first hydrogen-barrier film and a second

hydrogen-barrier film, wherein the first hydrogen-barrier film ~~having a cross section of a recess~~ is formed along the opening ~~open trench~~, while the second hydrogen-barrier film is formed on the second interlayer dielectric film and the end portion of the second hydrogen-barrier film is connected to the first hydrogen-barrier film.

5. (Currently amended) The semiconductor device of Claim 2, further comprising:

a second interlayer dielectric film formed over the first interlayer dielectric film so as to cover the upper hydrogen-barrier film, and

a third interlayer dielectric film formed on the second interlayer dielectric film and located to the lateral portion of the capacitor,

wherein a lower contact plug, which passes through the second interlayer dielectric film, is formed in a region of the second interlayer dielectric film which is located to the lateral portion of the capacitor, and

an upper contact plug is formed in a region of the third interlayer dielectric film ~~which is located to the lateral portion of the capacitor~~, wherein the upper contact plug passes through the third interlayer dielectric film and is electrically connected with the lower contact plug.

6. (Original) The semiconductor device of Claim 2, wherein the lower hydrogen-barrier film or the upper hydrogen-barrier film is made of an insulative material, and

the insulative material is made of silicon nitride, silicon oxynitride, aluminum oxide, titanium aluminum oxide, tantalum aluminum oxide, titanium silicate oxide, or tantalum silicate oxide.

7. (Original) The semiconductor device of Claim 2, wherein an oxygen-barrier film for preventing oxygen diffusion is provided under the capacitor.

8. (Original) The semiconductor device of Claim 7, wherein the oxygen-barrier film is

made of iridium, iridium oxide, ruthenium, or ruthenium oxide.

9. (Original) The semiconductor device of Claim 7, wherein the oxygen-barrier film is made of any one of an iridium oxide film, a multilayer film composed of an iridium film and an iridium oxide film that are sequentially formed from the lowermost layer, a ruthenium oxide film, and a multilayer film composed of a ruthenium film and a ruthenium oxide film that are sequentially formed from the lowermost layer, or is made of a multilayer film that includes at least two of these films.

10. (Original) The semiconductor device of Claim 2, wherein a conductive lower hydrogen-barrier film for preventing hydrogen diffusion is provided under the capacitor.

11. (Original) The semiconductor device of Claim 10, wherein the conductive lower hydrogen-barrier film is made of titanium aluminum nitride, titanium aluminum, titanium silicide nitride, tantalum nitride, tantalum silicide nitride, tantalum aluminum nitride, or tantalum aluminum.

12. (Original) The semiconductor device of Claim 10, wherein the conductive lower hydrogen-barrier film is made of a multilayer film that includes at least two of a titanium aluminum nitride film, a titanium aluminum film, a titanium silicide nitride film, a tantalum nitride film, a tantalum silicide nitride film, a tantalum aluminum nitride film, and a tantalum aluminum film.

13. (Original) The semiconductor device of Claim 10, wherein the conductive lower hydrogen-barrier film includes a multilayer film composed of a first conductive barrier layer for preventing oxygen diffusion and hydrogen diffusion, and a second conductive barrier layer for preventing oxygen diffusion.

14. (Currently amended) The semiconductor device of Claim 2, wherein a plurality of

the capacitors are arranged in a row to form a capacitor row, ~~and the upper electrodes forming the capacitor row are connected with each other to form a cell plate,~~ and

the capacitors are covered in capacitor row ~~cell-plate~~ units by the upper hydrogen-barrier film.

15. (Original) The semiconductor device of Claim 2, wherein a plurality of the capacitors are arranged to form a block, and

the capacitors are covered in block units by the upper hydrogen-barrier film.

16. (Currently amended) The semiconductor device of Claim 2, wherein a plurality of the capacitors are arranged in a matrix to form a capacitor array, and

the capacitors are covered in capacitor array [[capacitor-array]] units by the upper hydrogen-barrier film.

17. (Currently amended) The semiconductor device of Claim 2, wherein a plurality of the capacitors are arranged in rows to form capacitor rows, and the upper electrodes forming each said capacitor row are connected with each other to form a cell plate,

the capacitor rows are arranged to form blocks, and the blocks are arranged to form a capacitor array, and

the capacitors are covered by the upper hydrogen-barrier film in cell plate [[cell-plate]] units, block units, or capacitor array [[capacitor-array]] units, or are covered in a mixture of the cell plate [[cell-plate]] units and the block units.

18. (Original) The semiconductor device of Claim 2, wherein a plurality of the capacitors are arranged, and

among the capacitors, capacitors located adjacent to the peripheral portion of the upper hydrogen-barrier film are non-actuating dummy capacitors that do not operate electrically.

19. (Original) The semiconductor device of Claim 2, further comprising:
a cell-selecting transistor formed in a semiconductor substrate, and
a bit line formed over the semiconductor substrate, the bit line being electrically
connected with the cell-selecting transistor,

wherein the bit line is connected with another interconnect where the bit line is located
outside the lower and upper hydrogen-barrier films.

20. (Original) The semiconductor device of Claim 19, wherein the bit line is formed
underneath the lower hydrogen-barrier film.

21. (Original) The semiconductor device of Claim 19, wherein the bit line is formed
between the lower hydrogen-barrier film and the semiconductor substrate.

22. (Original) The semiconductor device of Claim 19, wherein the bit line is formed
under the lower hydrogen-barrier film so as to be in contact with the lower hydrogen-barrier
film.

23. (Original) The semiconductor device of Claim 2, wherein the upper electrode of the
capacitor and the upper hydrogen-barrier film are in contact with each other.

24. (Original) The semiconductor device of Claim 2, further comprising an interconnect
formed directly on the upper hydrogen-barrier film.

25. (Original) The semiconductor device of Claim 2, further comprising:
a cell-selecting transistor formed in a semiconductor substrate and having a source region
and a drain region;

a second interlayer dielectric film formed on the semiconductor substrate and covering
the cell-selecting transistor; and

a contact plug in the second interlayer dielectric film, the contact plug electrically

connecting the lower electrode with the source region or the drain region.

26. (Currently amended) The semiconductor device of Claim 2, further comprising:
a plurality of cell-selecting transistors formed in a semiconductor substrate,
wherein a plurality of the capacitors are arranged ~~ranged~~ to form a capacitor row
[[rows]], while the upper electrodes of the capacitors are connected with each other to form a cell
plate ~~plates~~;

~~the each~~ cell-selecting transistor is ~~transistors are~~ electrically connected with one of the
capacitors by a contact plug ~~plugs~~;

the capacitor row includes a ~~rows include~~ conducting dummy capacitor ~~capacitors~~ that is
~~are~~ the same in structure as the capacitor ~~capacitors~~; and

an upper electrode and a lower electrode in the ~~each said~~ conducting dummy capacitor
are electrically connected with each other, so that the cell plate is ~~plates are~~ electrically
connected with the semiconductor substrate via the contact plug of the conducting dummy
capacitor ~~plugs~~.

27. (Currently amended) The semiconductor device of Claim 26, wherein the lower
hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an insulative
lower hydrogen-barrier film, wherein the ~~each said~~ conductive lower hydrogen-barrier film is
formed between each said cell-selecting transistor and each said capacitor, while the insulative
lower hydrogen-barrier film is formed between the capacitor rows, and

the conductive lower hydrogen-barrier film is ~~films are~~ formed on the insulative lower
hydrogen-barrier film so as to cover the upper surface ~~surfaces~~ of the contact plug ~~plugs~~.

28. (Currently amended) The semiconductor device of Claim 26 [[27]], wherein the
lower hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an

insulative lower hydrogen-barrier film, wherein ~~the each said~~ conductive lower hydrogen-barrier film is formed between each said cell-selecting transistor and each said capacitor, while the insulative lower hydrogen-barrier film is formed between the capacitor rows, and

the end face ~~faces~~ of the conductive lower hydrogen-barrier film is ~~films are~~ in contact with the insulative lower hydrogen-barrier film.

29. (Currently amended) The semiconductor device of Claim 26 ~~[[28]]~~, wherein the lower hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an insulative lower hydrogen-barrier film, wherein ~~the each said~~ conductive lower hydrogen-barrier film is formed between each said cell-selecting transistor and each said capacitor, while the insulative lower hydrogen-barrier film is formed between the capacitor rows, and

the conductive lower hydrogen-barrier film is ~~films are~~ formed on the lateral face ~~faces~~ of the contact plug ~~plugs~~, so that the conductive lower hydrogen-barrier film is ~~films are~~ in contact with the insulative lower hydrogen-barrier film.

30. (Original) The semiconductor device of Claim 2, wherein the lower electrode or the upper electrode contains an element of the platinum group.

31. (Original) The semiconductor device of Claim 2, wherein the capacitive insulating film is made of a substance, which is expressed by the general formula $\text{SrBi}_2(\text{Ta}_x\text{Nb}_{1-x})_2\text{O}_9$, $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$, $(\text{Ba}_x\text{Sr}_{1-x})\text{TiO}_3$, $(\text{Bi}_x\text{La}_{1-x})_4\text{Ti}_3\text{O}_{12}$ (wherein $0 \leq x \leq 1$ in the formulas), or Ta_2O_5 .

32. (Currently amended) A semiconductor device comprising:
a lower hydrogen-barrier film;
one or more capacitors, each formed on the lower hydrogen-barrier film and including a lower electrode, a capacitive insulating film, and an upper electrode;
an ~~a first~~ interlayer dielectric film formed so as to cover the capacitor; and

an upper hydrogen-barrier film formed on the interlayer dielectric film ~~covering the top and lateral portions of the capacitor,~~

wherein an open trench, which exposes the lower hydrogen-barrier film where the lower hydrogen-barrier film is located around the capacitor, is formed in the ~~first~~ interlayer dielectric film, and

the upper hydrogen-barrier film is formed along the lateral and bottom faces of ~~has a portion in the form of a recess formed along the open trench, and the recess-shaped portion is in contact with the lower hydrogen-barrier film~~ in the open trench.

33. (Currently amended) The semiconductor device of Claim 32, wherein ~~the recess of~~ the upper hydrogen-barrier film formed along the open trench has a cross-sectional configuration that is tapered and flares upward.

34. (Currently amended) The semiconductor device of Claim 32, wherein the upper hydrogen-barrier film is filled in the open trench ~~recess~~.

35. (Currently amended) The semiconductor device of Claim 32, wherein ~~the lower electrode, capacitive insulating film, and upper electrode of the capacitor~~ has ~~have~~ a concave cross-sectional configuration ~~that is tapered and flares upward.~~

36-37. (Cancelled)

38. (Currently amended) The semiconductor device of Claim 32, wherein a plurality of open trenches, which expose the lower hydrogen-barrier film, are formed in parallel with each other in the ~~first~~ interlayer dielectric film ~~[[, and]]~~

~~the upper hydrogen-barrier film has portions that are each in the form of a recess, and are formed along the open trenches, where the upper hydrogen-barrier film is located to the lateral portion of the first interlayer dielectric film, and the respective recess-shaped portions are in~~

~~contact with the lower hydrogen-barrier film.~~

39. (Original) The semiconductor device of Claim 32, wherein the lower hydrogen-barrier film or the upper hydrogen-barrier film is made of an insulative material, and the insulative material is made of silicon nitride, silicon oxynitride, aluminum oxide, titanium aluminum oxide, tantalum aluminum oxide, titanium silicate oxide, or tantalum silicate oxide.

40. (Original) The semiconductor device of Claim 32, wherein an oxygen-barrier film for preventing oxygen diffusion is provided under the capacitor.

41. (Original) The semiconductor device of Claim 40, wherein the oxygen-barrier film is made of iridium, iridium oxide, ruthenium, or ruthenium oxide.

42. (Original) The semiconductor device of Claim 40, wherein the oxygen-barrier film is made of any one of an iridium oxide film, a multilayer film composed of an iridium film and an iridium oxide film that are sequentially formed from the lowermost layer, a ruthenium oxide film, and a multilayer film composed of a ruthenium film and a ruthenium oxide film that are sequentially formed from the lowermost layer, or is made of a multilayer film that includes at least two of these films.

43. (Original) The semiconductor device of Claim 32, wherein a conductive lower hydrogen-barrier film for preventing hydrogen diffusion is provided under the capacitor.

44. (Original) The semiconductor device of Claim 43, wherein the conductive lower hydrogen-barrier film is made of titanium aluminum nitride, titanium aluminum, titanium silicide nitride, tantalum nitride, tantalum silicide nitride, tantalum aluminum nitride, or tantalum aluminum.

45. (Original) The semiconductor device of Claim 43, wherein the conductive lower

hydrogen-barrier film is made of a multilayer film that includes at least two of a titanium aluminum nitride film, a titanium aluminum film, a titanium silicide nitride film, a tantalum nitride film, a tantalum silicide nitride film, a tantalum aluminum nitride film, and a tantalum aluminum film.

46. (Original) The semiconductor device of Claim 43, wherein the conductive lower hydrogen-barrier film includes a multilayer film composed of a first conductive barrier layer for preventing oxygen diffusion and hydrogen diffusion, and a second conductive barrier layer for preventing oxygen diffusion.

47. (Currently amended) The semiconductor device of Claim 32, wherein a plurality of the capacitors are arranged in a row to form a capacitor row, ~~and the upper electrodes forming the capacitor row are connected with each other to form a cell plate,~~ and

the capacitors are covered in capacitor row [[cell-plate]] units by the upper hydrogen-barrier film.

48. (Original) The semiconductor device of Claim 32, wherein a plurality of the capacitors are arranged to form a block, and

the capacitors are covered in block units by the upper hydrogen-barrier film.

49. (Currently amended) The semiconductor device of Claim 32, wherein a plurality of the capacitors are arranged in a matrix to form a capacitor array, and

the capacitors are covered in capacitor array [[capacitor-array]] units by the upper hydrogen-barrier film.

50. (Currently amended) The semiconductor device of Claim 32, wherein a plurality of the capacitors are arranged in rows to form capacitor rows, and the upper electrodes forming each said capacitor row are connected with each other to form a cell plate;

the capacitor rows are arranged to form blocks, and the blocks are arranged to form a capacitor array; and

the capacitors are covered by the upper hydrogen-barrier film in cell plate [[cell-plate]] units, block units, or capacitor array [[capacitor-array]] units, or are covered in a mixture of the cell plate [[cell-plate]] units and the block units.

51. (Original) The semiconductor device of Claim 32, wherein a plurality of the capacitors are arranged, and

among the capacitors, capacitors located adjacent to the peripheral portion of the upper hydrogen-barrier film are non-actuating dummy capacitors that do not operate electrically.

52. (Original) The semiconductor device of Claim 32, further comprising:

a cell-selecting transistor formed in a semiconductor substrate, and

a bit line formed over the semiconductor substrate, the bit line being electrically connected with the cell-selecting transistor,

wherein the bit line is connected with another interconnect where the bit line is located outside the lower and upper hydrogen-barrier films.

53. (Original) The semiconductor device of Claim 52, wherein the bit line is formed underneath the lower hydrogen-barrier film.

54. (Original) The semiconductor device of Claim 52, wherein the bit line is formed between the lower hydrogen-barrier film and the semiconductor substrate.

55. (Original) The semiconductor device of Claim 52, wherein the bit line is formed under the lower hydrogen-barrier film so as to be in contact with the lower hydrogen-barrier film.

56. (Cancelled)

57. (Original) The semiconductor device of Claim 32, wherein the upper electrode of the capacitor and the upper hydrogen-barrier film are in contact with each other.

58. (Original) The semiconductor device of Claim 32, further comprising an interconnect formed directly on the upper hydrogen-barrier film.

59. (Original) The semiconductor device of Claim 32, further comprising:
a cell-selecting transistor formed in a semiconductor substrate and having a source region and a drain region;

a second interlayer dielectric film formed on the semiconductor substrate and covering the cell-selecting transistor; and

a contact plug in the second interlayer dielectric film, the contact plug electrically connecting the lower electrode with the source region or the drain region.

60. (Currently amended) The semiconductor device of Claim 32, further comprising:
a plurality of cell-selecting transistors formed in a semiconductor substrate,
wherein a plurality of the capacitors are arranged ~~ranged~~ to form a capacitor row ~~rows~~,
while the upper electrodes of the capacitors are connected with each other to form a cell plate ~~plates~~;

each ~~the~~ cell-selecting transistor is ~~transistors are~~ electrically connected with one of the capacitors by a contact plug ~~plugs~~;

the capacitor row includes a ~~rows include~~ conducting dummy capacitor ~~capacitors~~ that is ~~are~~ the same in structure as the capacitor ~~capacitors~~; and

an upper electrode and a lower electrode in the ~~each said~~ conducting dummy capacitor are electrically connected with each other, so that the cell plate is ~~plates are~~ electrically connected with the semiconductor substrate via the contact plug of the conducting dummy

capacitor plugs.

61. (Currently amended) The semiconductor device of Claim 60, wherein the lower hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an insulative lower hydrogen-barrier film, wherein the ~~each-said~~ conductive lower hydrogen-barrier film is formed between each said cell-selecting transistor and each said capacitor, while the insulative lower hydrogen-barrier film is formed between the capacitor rows, and

the conductive lower hydrogen-barrier film is ~~films-are~~ formed on the insulative lower hydrogen-barrier film so as to cover the upper surface ~~surfaees~~ of the contact plug ~~plugs~~.

62. (Currently amended) The semiconductor device of Claim 60, wherein the lower hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an insulative lower hydrogen-barrier film, wherein the ~~each-said~~ conductive lower hydrogen-barrier film is formed between each said cell-selecting transistor and each said capacitor, while the insulative lower hydrogen-barrier film is formed between the capacitor rows, and

the end face ~~faees~~ of the conductive lower hydrogen-barrier film is ~~films-are~~ in contact with the insulative lower hydrogen-barrier film.

63. (Currently amended) The semiconductor device of Claim 60, wherein the lower hydrogen-barrier film includes a conductive lower hydrogen-barrier film ~~films~~ and an insulative lower hydrogen-barrier film, wherein the ~~each-said~~ conductive lower hydrogen-barrier film is formed between each said cell-selecting transistor and each said capacitor, while the insulative lower hydrogen-barrier film is formed between the capacitor rows, and

the conductive lower hydrogen-barrier film is ~~films-are~~ formed on the lateral face ~~faees~~ of the contact plug ~~plugs~~, so that the conductive lower hydrogen-barrier film is ~~films-are~~ in contact with the insulative lower hydrogen-barrier film.

64. (Original) The semiconductor device of Claim 32, wherein the lower electrode or the upper electrode contains an element of the platinum group.

65. (Original) The semiconductor device of Claim 32, wherein the capacitive insulating film is made of a substance, which is expressed by the general formula $\text{SrBi}_2(\text{Ta}_x\text{Nb}_{1-x})_2\text{O}_9$, $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$, $(\text{Ba}_x\text{Sr}_{1-x})\text{TiO}_3$, $(\text{Bi}_x\text{La}_{1-x})_4\text{Ti}_3\text{O}_{12}$ (wherein $0 \leq x \leq 1$ in the formulas), or Ta_2O_5 .

66-102. (Cancelled)

103. (New) The semiconductor device of Claim 32, wherein the open trench has a cross-sectional configuration that is broadened upward from the bottom of the open trench.

104. (New) The semiconductor device of Claim 32, wherein a plurality of capacitors are arranged, and

the plurality of capacitors are covered in plural units by the upper hydrogen-barrier film and the lower hydrogen-barrier film.